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(54) **CLOUD-BASED PERSONAL TRAIT PROFILE DATA**

(75) Inventors: **Kathryn Stone Perez**, Kirkland, WA (US); **Alex Aben-Athar Kipman**, Redmond, WA (US); **John Clavin**, Seattle, WA (US); **Joseph Molnar**, Belleveu, WA (US); **Aaron E. Kornblum**, Mercer Island, WA (US)

(73) Assignee: **Microsoft Technology Licensing, LLC**, Redmond, WA (US)

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CPC ***G06F 3/011*** (2013.01); ***G06F 3/017*** (2013.01); ***G06F 21/32*** (2013.01); ***G06F 21/34*** (2013.01)

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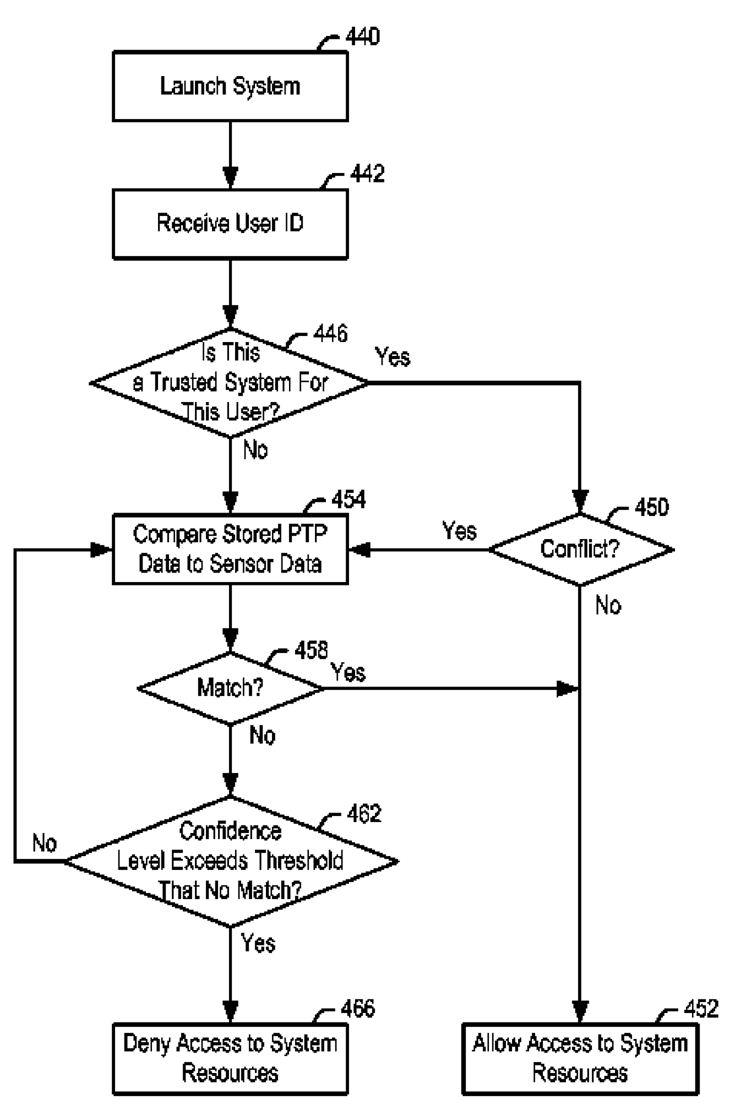
Primary Examiner — James Turchen

(74) *Attorney, Agent, or Firm* — Micah Goldsmith; Judy Yee; Micky Minhas

(57) **ABSTRACT**

A system and method is disclosed for sensing, storing and using personal trait profile data. Once sensed and stored, this personal trait profile data may be used for a variety of purposes. In one example, a user's personal trait profile data may be accessed and downloaded to different computing systems with which a user may interact so that the different systems may be instantly tuned to the user's personal traits and manner of interaction. In a further example, a user's personal trait profile data may also be used for authentication purposes.

10 Claims, 10 Drawing Sheets



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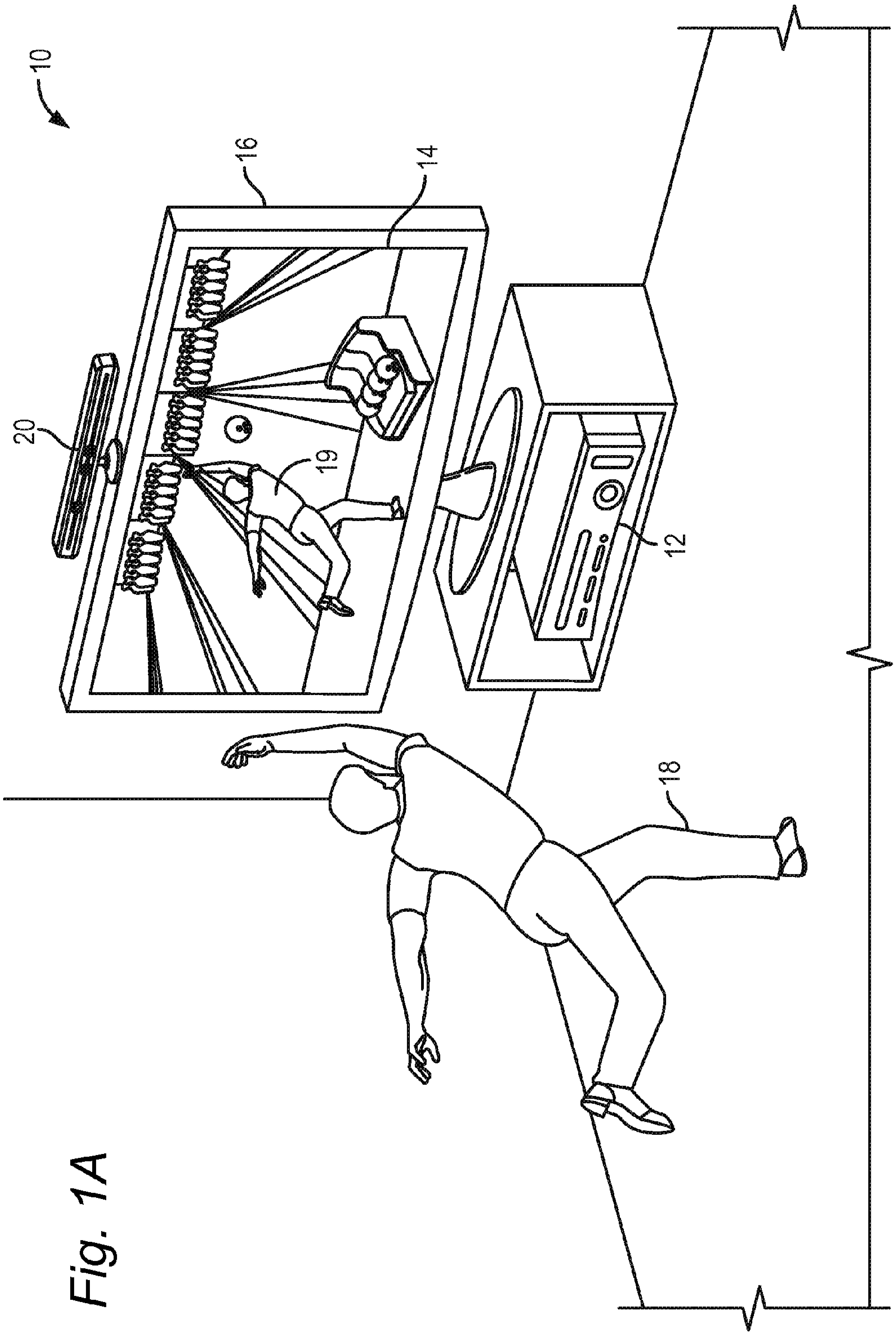


Fig. 1A

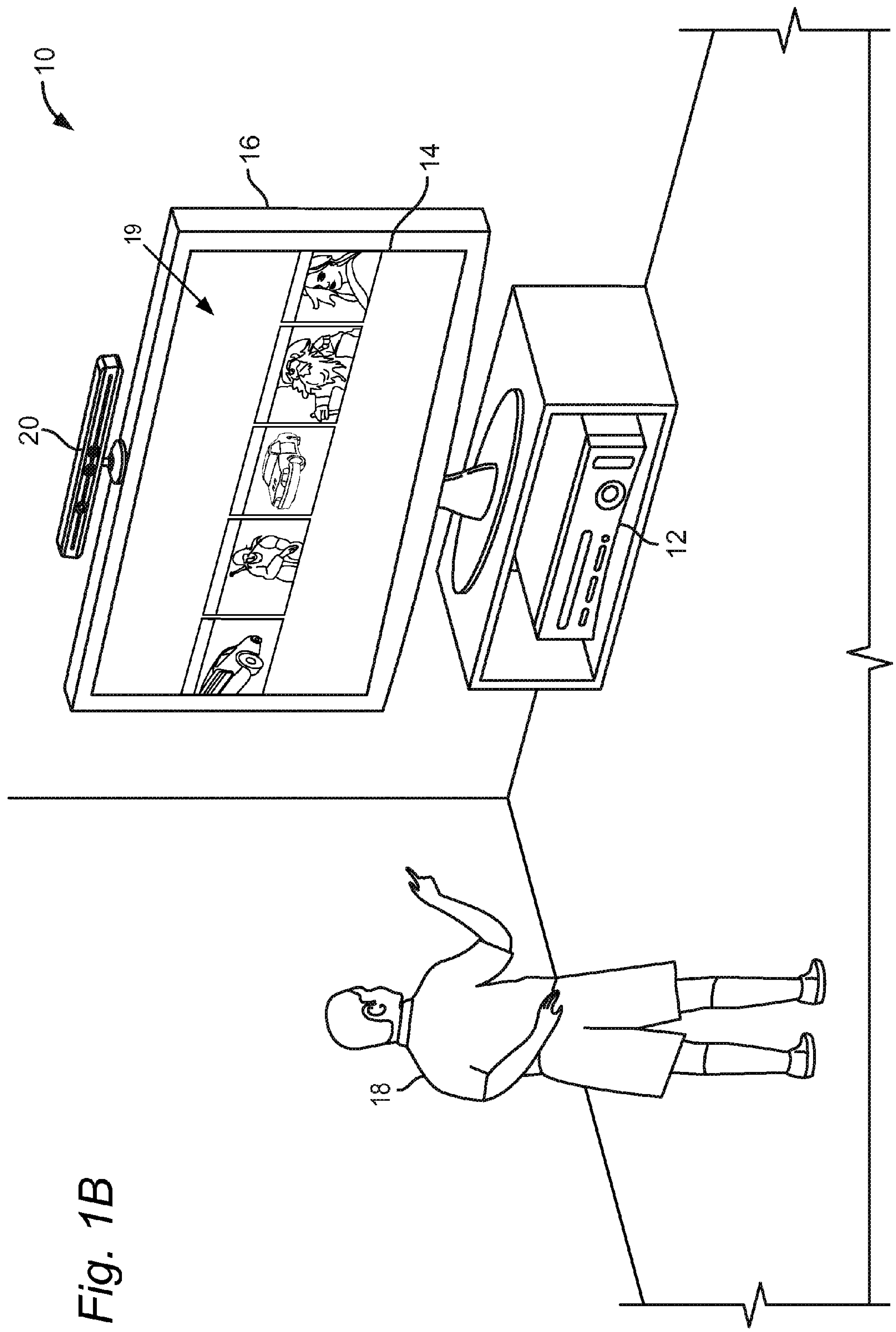


Fig. 1B

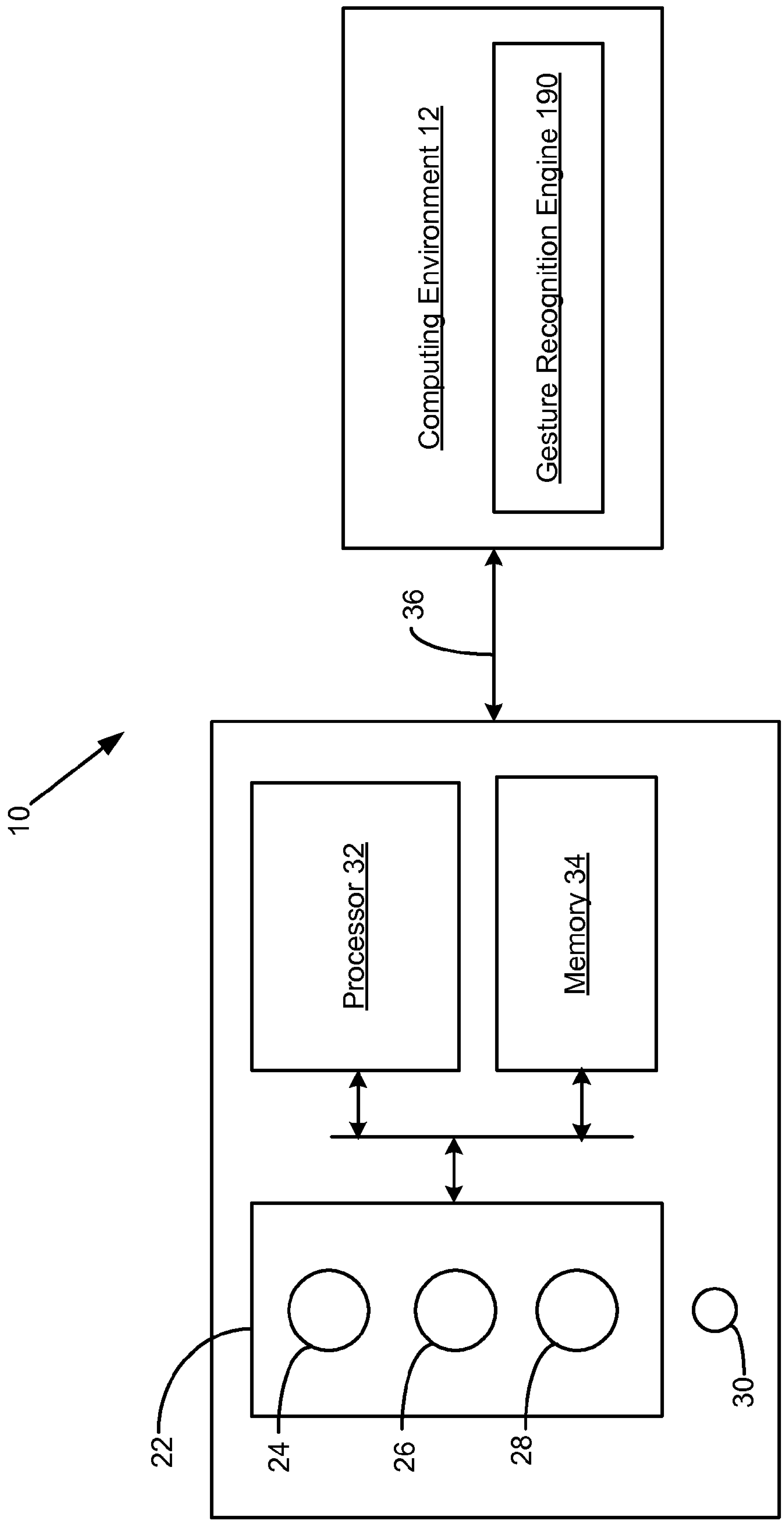

Computing Environment 12
Gesture Recognition Engine 190
36
10
Processor 32
Memory 34
22
24
26
28
30

Fig. 2

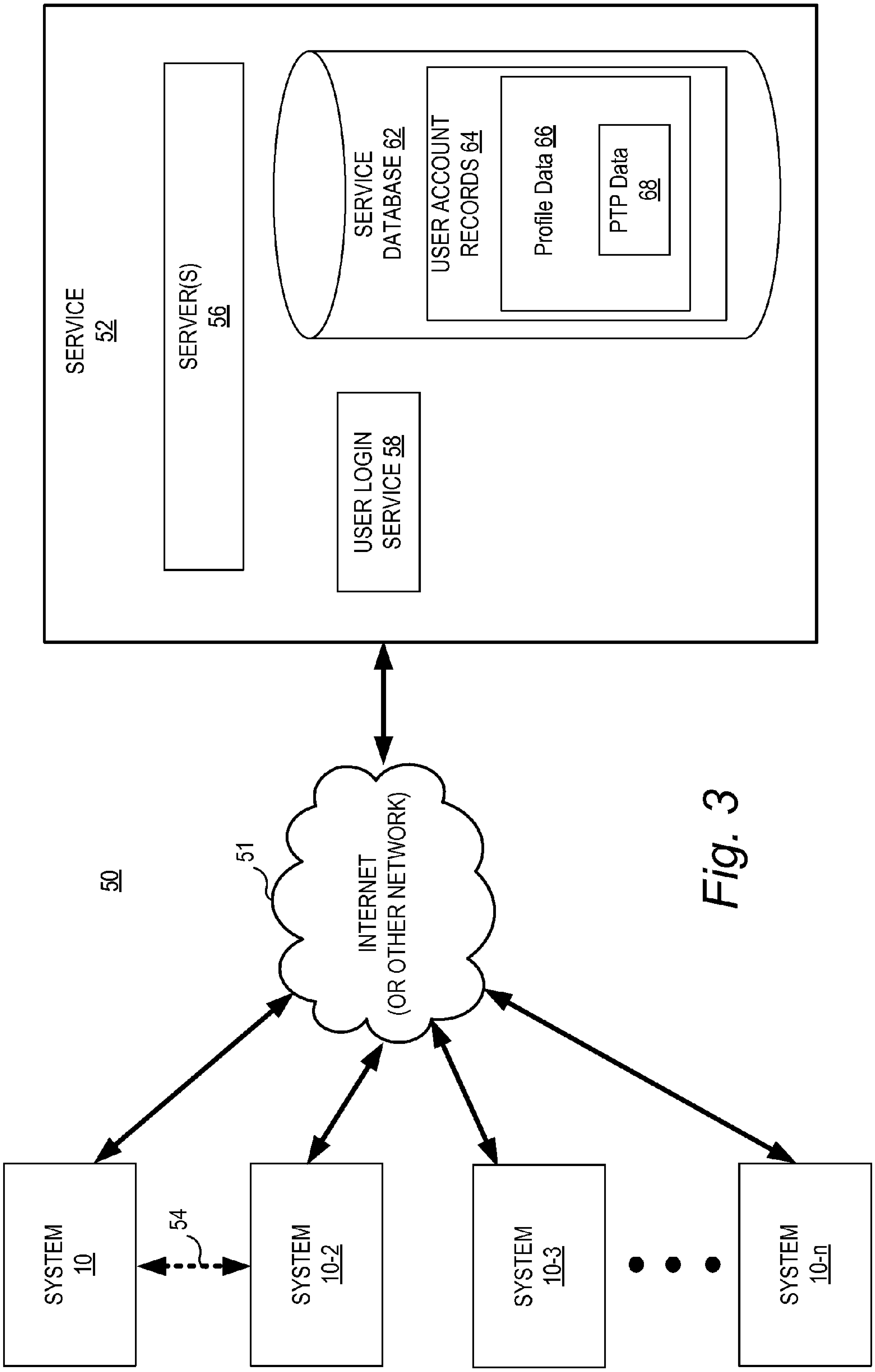
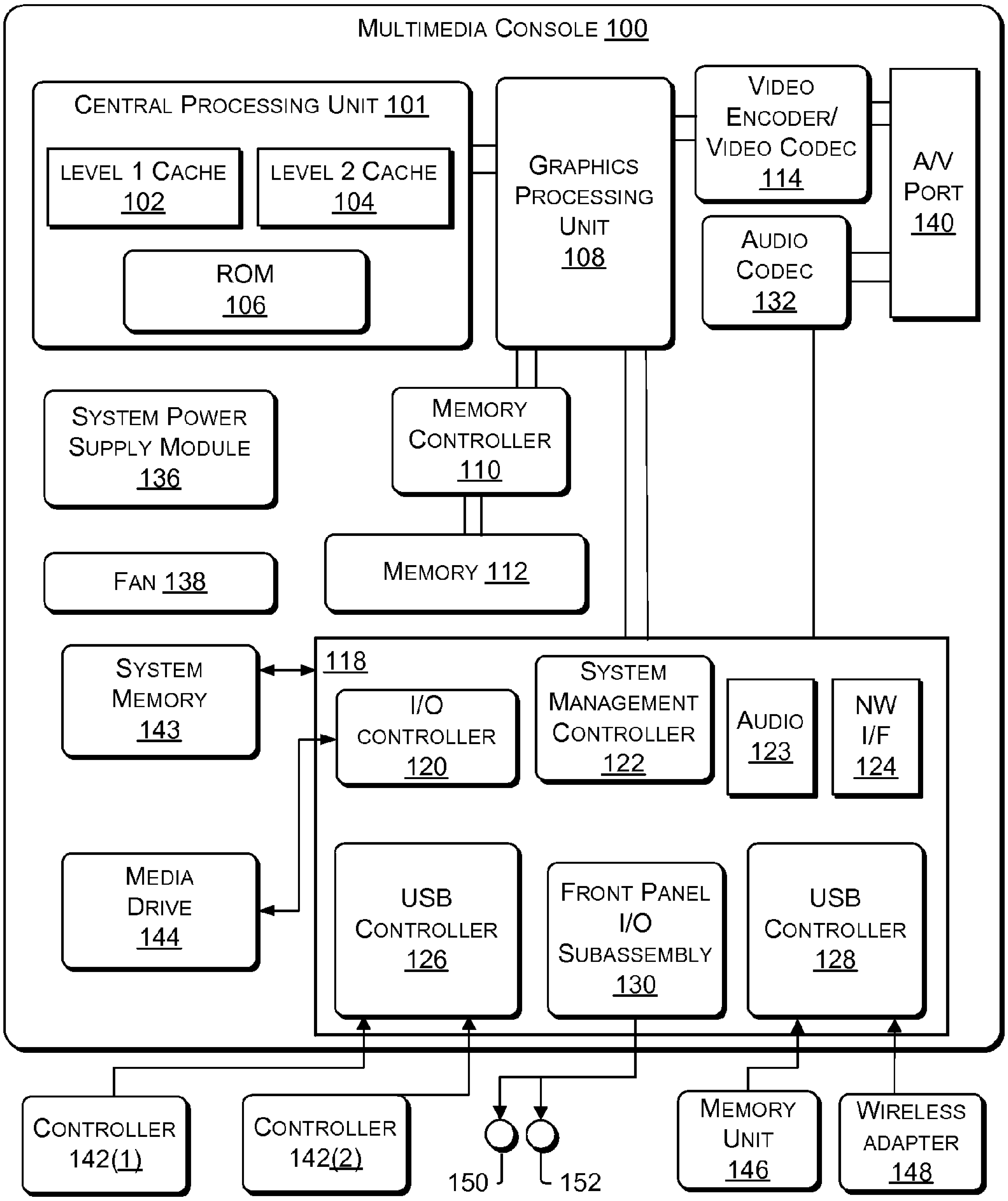

SERVICE
52
SERVER(S)
56
SERVICE
DATABASE 62
USER ACCOUNT
RECORDS 64
Profile Data 66
PTP Data
68
USER LOGIN
SERVICE 58
50
51
INTERNET
(OR OTHER NETWORK)
54
SYSTEM
10
SYSTEM
10-2
SYSTEM
10-3
SYSTEM
10-n

Fig. 3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CENTRAL PROCESSING UNIT 101
LEVEL 1 CACHE 102
LEVEL 2 CACHE 104
ROM 106
GRAPHICS PROCESSING UNIT 108
VIDEO ENCODER/ VIDEO CODEC 114
A/V PORT 140
AUDIO CODEC 132
SYSTEM POWER SUPPLY MODULE 136
MEMORY CONTROLLER 110
FAN 138
MEMORY 112
SYSTEM MEMORY 143
118
I/O CONTROLLER 120
SYSTEM MANAGEMENT CONTROLLER 122
AUDIO 123
NW I/F 124
MEDIA DRIVE 144
USB CONTROLLER 126
FRONT PANEL I/O SUBASSEMBLY 130
USB CONTROLLER 128
CONTROLLER 142(1)
CONTROLLER 142(2)
150
152
MEMORY UNIT 146
WIRELESS ADAPTER 148

Fig. 4A

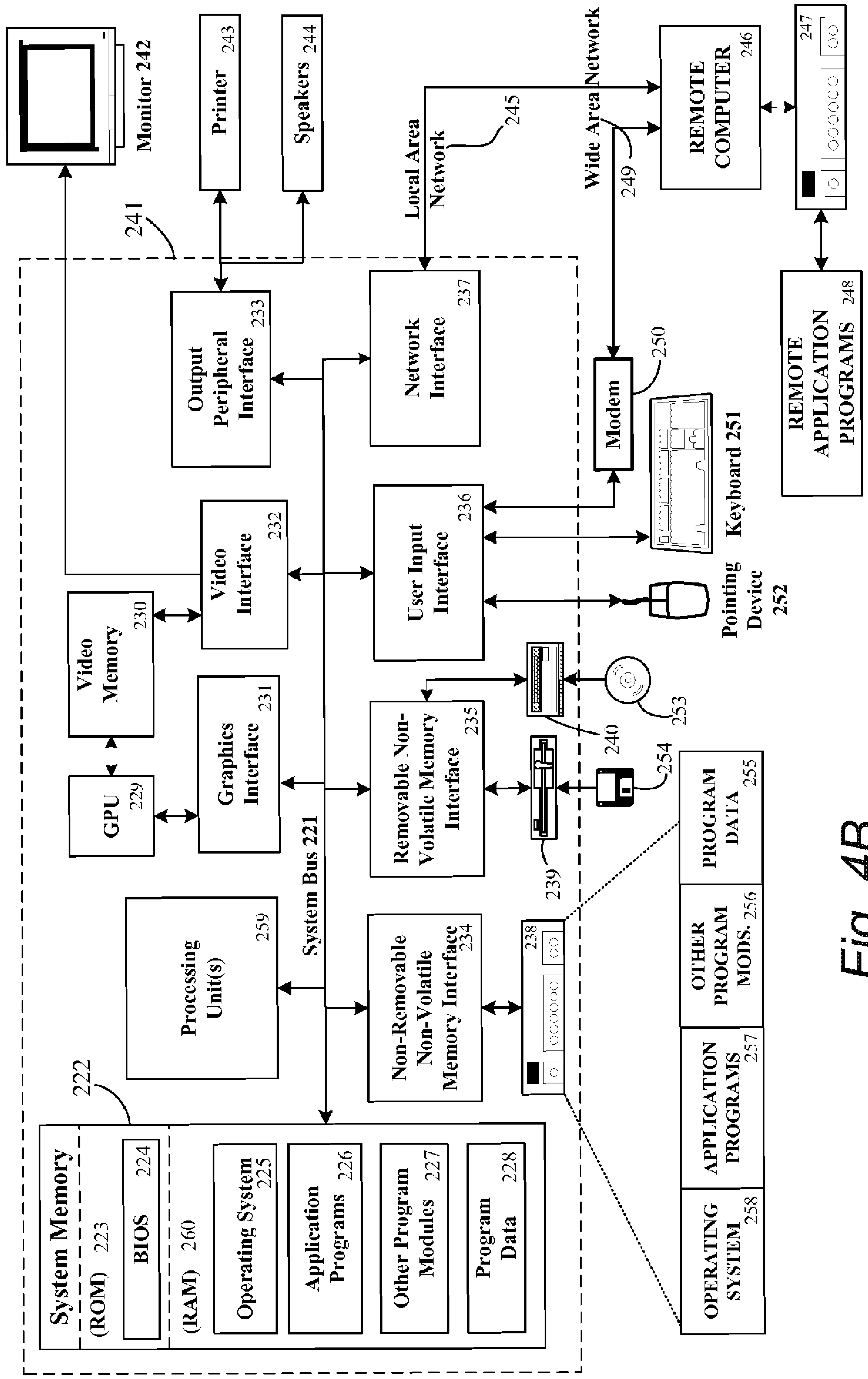
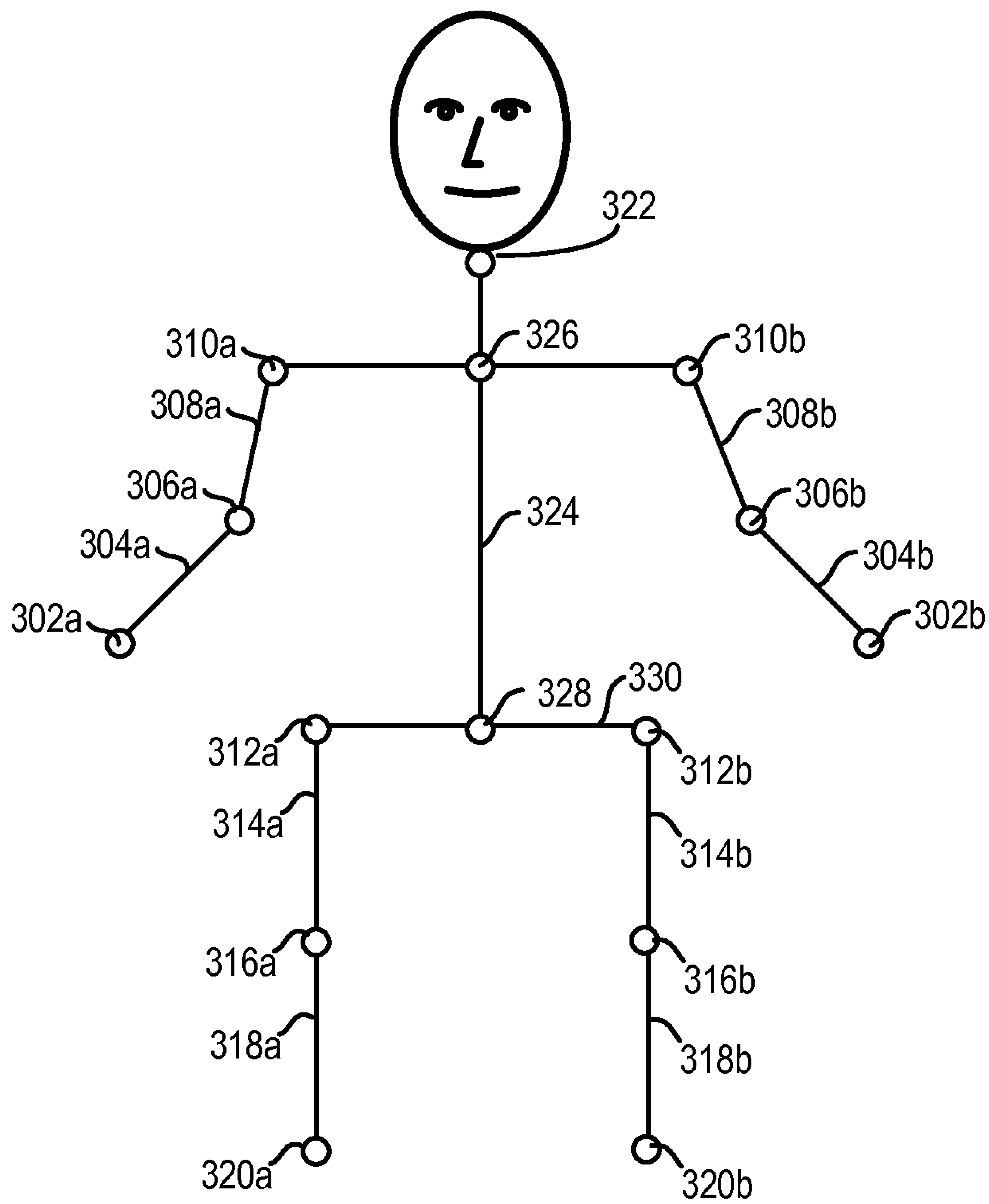

Computing Environment 220
System Memory
222
(ROM) 223
BIOS 224
(RAM) 260
Operating System 225
Application Programs 226
Other Program Modules 227
Program Data 228
Processing Unit(s) 259
System Bus 221
GPU 229
Video Memory 230
Graphics Interface 231
Video Interface 232
Output Peripheral Interface 233
Non-Removable Non-Volatile Memory Interface 234
Removable Non-Volatile Memory Interface 235
User Input Interface 236
Network Interface 237
238
239
240
241
Monitor 242
Printer 243
Speakers 244
Local Area Network
245
Wide Area Network
249
REMOTE COMPUTER 246
247
REMOTE APPLICATION PROGRAMS 248
Modem 250
Keyboard 251
Pointing Device 252
253
254
PROGRAM DATA 255
OTHER PROGRAM MODS. 256
APPLICATION PROGRAMS 257
OPERATING SYSTEM 258

Fig. 4B

Fig. 5


322
326
310a
310b
308a
308b
306a
306b
324
304a
304b
302a
302b
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312a
312b
314a
314b
316a
316b
318a
318b
320a
320b

Fig. 6

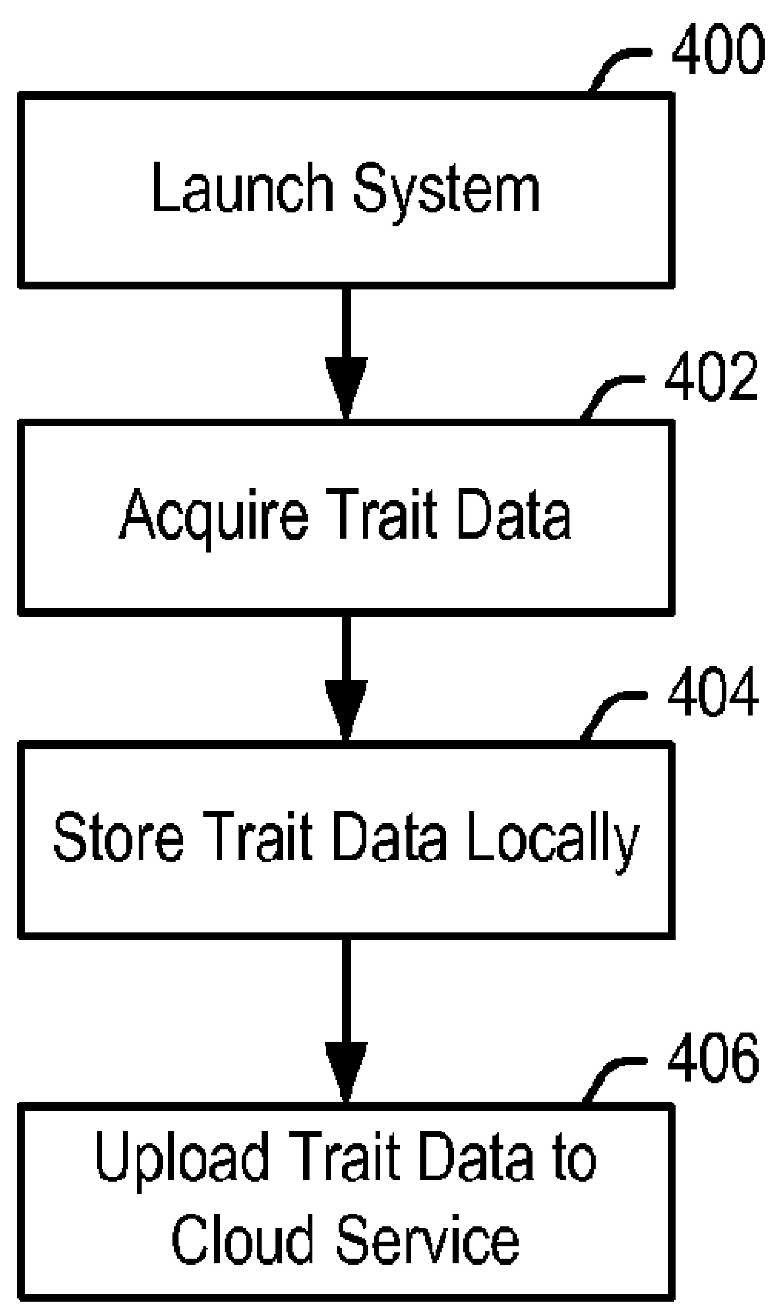

400
Launch System
402
Acquire Trait Data
404
Store Trait Data Locally
406
Upload Trait Data to Cloud Service

Fig. 7

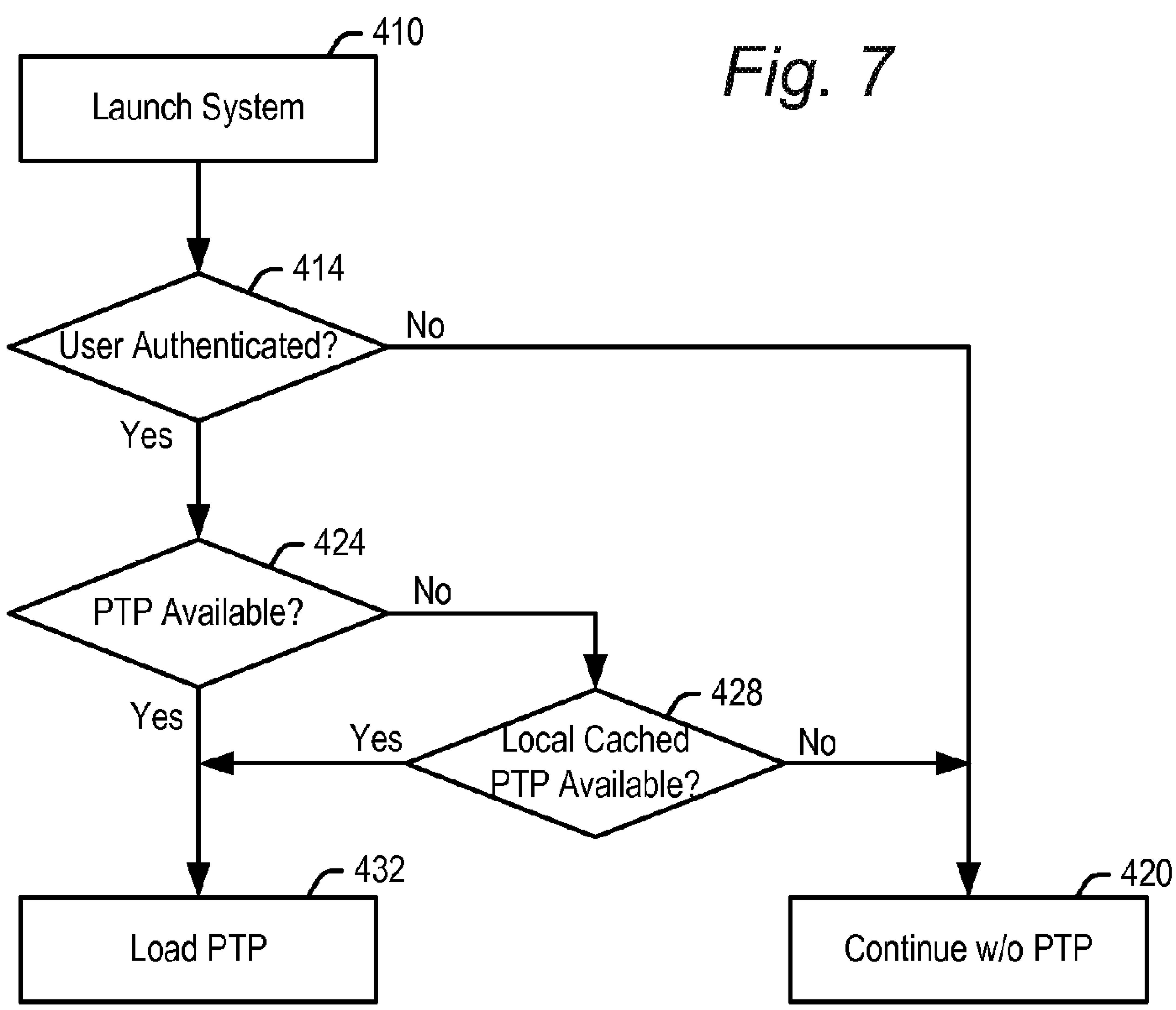

410
Launch System
414
User Authenticated?
No
Yes
424
PTP Available?
No
Yes
428
Local Cached PTP Available?
Yes
No
432
Load PTP
420
Continue w/o PTP

Fig. 8

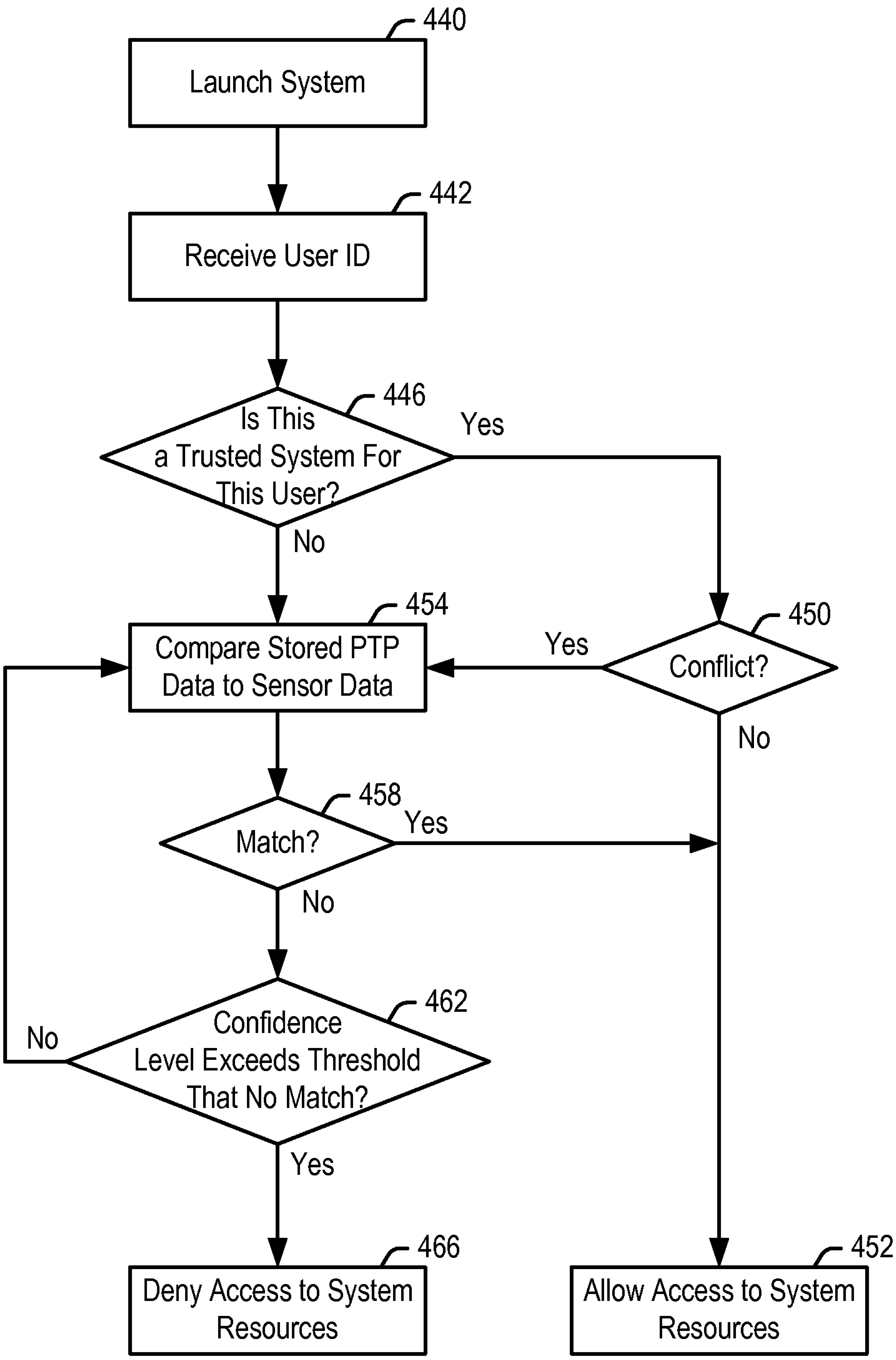
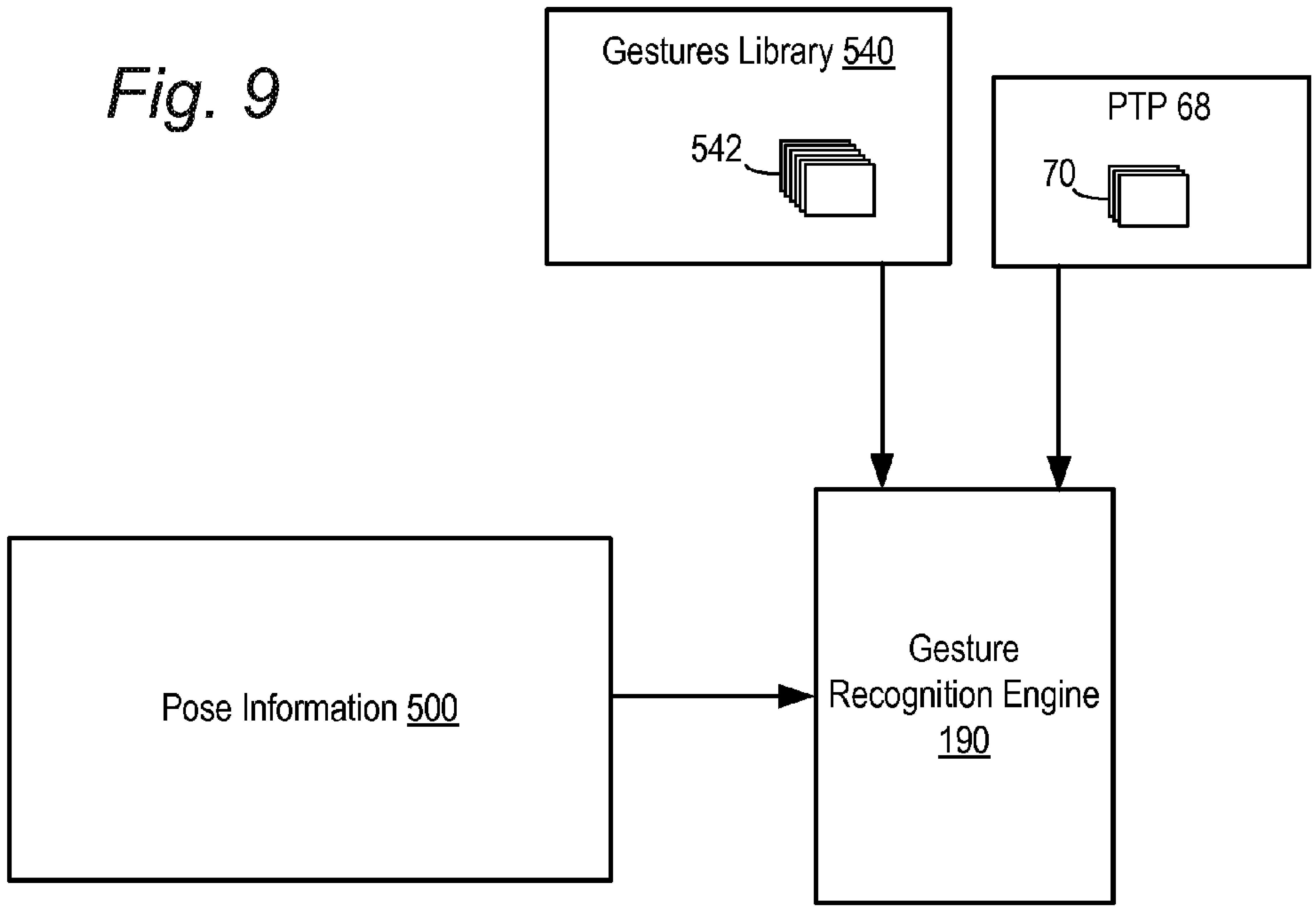

440
Launch System
442
Receive User ID
446
Is This a Trusted System For This User?
Yes
No
454
Compare Stored PTP Data to Sensor Data
450
Conflict?
Yes
No
458
Match?
Yes
No
462
Confidence Level Exceeds Threshold That No Match?
No
Yes
466
Deny Access to System Resources
452
Allow Access to System Resources

Fig. 9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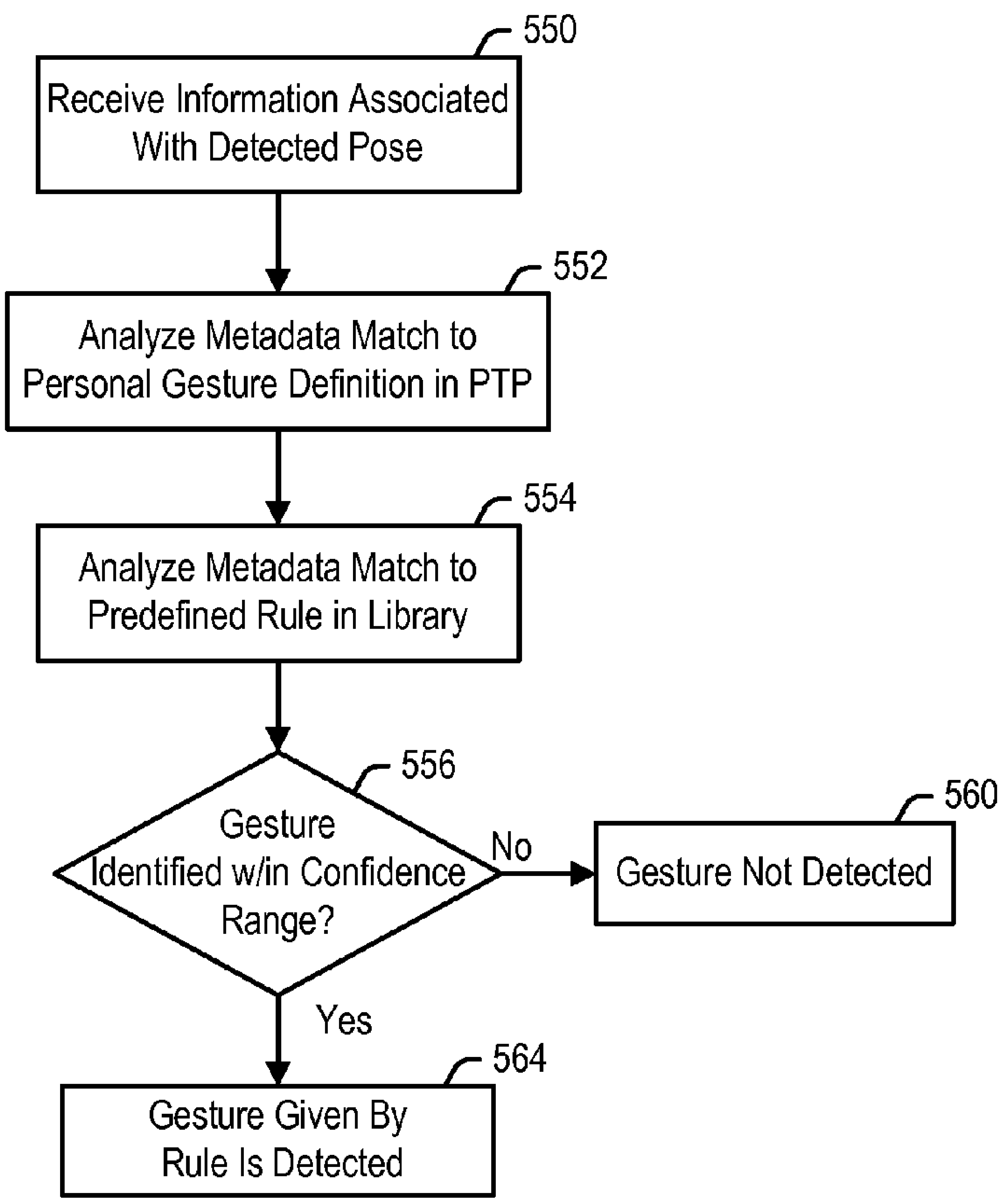
542
PTP 68
70
Pose Information 500
Gesture Recognition Engine 190

Fig. 10


550
Receive Information Associated With Detected Pose
552
Analyze Metadata Match to Personal Gesture Definition in PTP
554
Analyze Metadata Match to Predefined Rule in Library
556
Gesture Identified w/in Confidence Range?
No
560
Gesture Not Detected
Yes
564
Gesture Given By Rule Is Detected

CLOUD-BASED PERSONAL TRAIT PROFILE DATA

BACKGROUND

In the past, computing applications such as computer games and multimedia applications used controllers, remotes, keyboards, mice, or the like to allow users to manipulate game characters or other aspects of an application. More recently, computer games and multimedia applications have begun employing cameras and software gesture recognition engines to provide a natural user interface ("NUT"). With NUI, user gestures are detected, interpreted and used to control game characters or other aspects of an application.

Mice and other such controllers provide a well-defined interface for interacting with computing systems. One of the challenges of NUI systems is that the interface is controlled by a user's interaction with, and perception of, the 3-D space in which they move. However, physical, societal and other personal traits make each user at least slightly different, and as such, different users interact with NUI systems in different ways. Thus, for example, where a user's performance of a gesture varies from the norm, the NUI system may not understand the user's intention. While a user's own NUI system can be tuned over time to their personal style of interaction, the user may have trouble interacting with NUI systems other than their own.

Despite presenting difficulties for a NUI system, a user's personal traits have potential benefits which at present are not being taken advantage of. For example, current systems go to lengths to ensure proper authentication of users through login protocols and passwords, but do not use the wealth of information provided by a user's personal traits for authentication purposes.

SUMMARY

Disclosed herein is a system for generating, storing and using a personal trait profile associated with a user. The personal trait profile may be generated by a first computing environment, and then stored at a central database accessible by a plurality of computing environments including the first computing environment. The personal trait profile may contain data relating to personal traits of a user that may be sensed by a capture device associated with the first computing device. These personal traits include, but are not limited to, physical characteristics of the user such as size, shape and hair; voice characteristics such as accent, pitch, tenor and cadence; and gestures that the user performs in an atypical manner.

Once generated and stored, a user's personal trait profile data may be used for a variety of purposes. In one example, a user's personal trait profile data may be accessed and downloaded to different computing systems with which a user may interact so that the different systems may be instantly tuned to the user's personal traits and manner of interaction. In a further example, a user's personal trait profile data may also be used for authentication purposes.

In one embodiment, the current technology relates to a method of improving a user experience with natural user interface systems. The method includes the steps of: a) acquiring data representing a trait of a user from a sensor of a natural user interface associated with a first computing environment; b) storing the trait data acquired in said step a) in a location accessible to a second computing environment distinct from the first computing environment; and c) providing the trait data stored in said step b) to the second computing environment.

In a further embodiment, the current technology relates to a method of improving a user experience in a system comprising a plurality of computing environments, a first computing environment coupled to a capture device for capturing traits of a user. The method includes the steps of: a) generating a personal trait profile for a user from data representing one or more traits of the user received from the capture device; b) storing the personal trait profile generated in said step a) in a location accessible to a second computing environment distinct from the first computing environment; and c) providing the personal trait profile stored in said step b) to the second computing environment upon access of the second computing environment by the user.

In a further embodiment, the current technology relates to a method of improving a user experience with the natural user interface in a system comprising one or more computing environments for gaming applications and a capture device for providing a natural user interface. The method includes the steps of: a) generating a personal trait profile for a user from data representing one or more traits of the user acquired from a capture device associated with a computing environment; b) storing the personal trait profile acquired in said step a); c) receiving a request for access to resources in a location storing the trait data stored in said step b); d) acquiring data representing one or more traits stored in the personal trait profile after said step c) of receiving the request for access to resources; e) comparing the data acquired in said step d) against the data stored in the personal trait profile; and f) granting the request for access to the resources if the comparison of said step e) shows a match between the data acquired in said step d) and the data stored in the personal trait profile.

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A illustrates an example embodiment of a target recognition, analysis, and tracking system with a user participating in a game.

FIG. **1**B illustrates a further example embodiment of a target recognition, analysis, and tracking system with a user operating a graphical user interface.

FIG. **2** illustrates an example embodiment of a capture device that may be used in a target recognition, analysis, and tracking system.

FIG. **3** illustrates a network topology for implementing embodiments of the present technology.

FIG. **4**A illustrates an example embodiment of a computing environment that may be used to interpret one or more gestures in a target recognition, analysis, and tracking system.

FIG. **4**B illustrates another example embodiment of a computing environment that may be used to interpret one or more gestures in a target recognition, analysis, and tracking system.

FIG. **5** illustrates a skeletal mapping of a user that has been generated from the target recognition, analysis, and tracking system of FIG. **2**.

FIG. **6** is a flowchart showing the generation and storage of a personal trait profile.

FIG. **7** is a flowchart showing the accessing of a personal trait profile.

FIG. **8** is a flowchart of a system for authentication using a personal trait profile.

FIG. **9** is a block diagram of a system for recognizing user gestures.

FIG. **10** is a flowchart of the operation of the system for recognizing user gestures shown in FIG. **9**.

DETAILED DESCRIPTION

Embodiments of the present technology will now be described with reference to FIGS. **1-10**, which in general relate to a system for generating, storing and using a personal trait profile associated with a given user. Once generated and stored, a user's personal trait profile data may be used for a variety of purposes. In one example, a user's personal trait profile data may be accessed and downloaded to different computing systems with which a user may interact so that the different systems may be instantly tuned to the user's personal traits and manner of interaction. In a further example, a user's personal trait profile data may also be used for authentication purposes.

Referring initially to FIGS. **1-2**, the hardware for implementing the present technology includes a target recognition, analysis, and tracking system **10** which may be a NUI system used to recognize, analyze, and/or track a human target such as the user **18**. Embodiments of the target recognition, analysis, and tracking system **10** include a computing environment **12** for executing a gaming or other application, and an audiovisual device **16** having a display **14** for providing audio and visual representations from the gaming or other application. The system **10** further includes a capture device **20** for detecting position and movement of a user captured by the device **20**, which the computing environment receives and uses to control the application. Each of these components is explained in greater detail below.

As shown in FIG. **1**A, in an example embodiment, the application executing on the computing environment **12** may be a bowling game that the user **18** may be playing. For example, the computing environment **12** may use the audiovisual display **14** to provide a visual representation of a bowling alley to the user **18**. The computing environment **12** may also use the display **14** to provide a visual representation of a player avatar **24** that the user **18** may control with his or her movements. For example, the user **18** may move and swing their arm to simulate bowling a bowling ball in physical space, and this motion is mimicked by the avatar **24** to bowl a virtual ball down the virtual bowling lane. Thus, according to an example embodiment, the computer environment **12** and the capture device **20** of the target recognition, analysis, and tracking system **10** may be used to recognize and analyze the user's approach and arm swing in physical space so as to be interpreted as a game control of the player avatar **24** in game space.

A bowling application is one of any number of applications for the NUI system **10** where a user's motion and/or position are interpreted by the computing environment as a predefined gesture for controlling some feature of the application. The system **10** may also have a wide variety of predefined gestures used as system controls which are not unique to a particular application. For example, FIG. **1**B shows a user interacting with a graphical user interface **19** displayed on display **14**. The interface **19** is a menu driven display, which the user is able to scroll through using predefined gestures.

FIG. **2** illustrates an example embodiment of the capture device **20** that may be used in the target recognition, analysis, and tracking system **10**. Further details relating to a capture device for use with the present technology are set forth in copending patent application Ser. No. 12/475,308, entitled "Device For Identifying And Tracking Multiple Humans Over Time," which application is incorporated herein by reference in its entirety. However, in an example embodiment, the capture device **20** may be configured to capture video having a depth image that may include depth values via any suitable technique including, for example, time-of-flight, structured light, stereo image, or the like. According to one embodiment, the capture device **20** may organize the calculated depth information into "Z layers," or layers that may be perpendicular to a Z axis extending from the depth camera along its line of sight.

As shown in FIG. **2**, the capture device **20** may include an image camera component **22**. According to an example embodiment, the image camera component **22** may be a depth camera that may capture the depth image of a scene. The depth image may include a two-dimensional (2-D) pixel area of the captured scene where each pixel in the 2-D pixel area may represent a length in, for example, centimeters, millimeters, or the like of an object in the captured scene from the camera.

As shown in FIG. **2**, according to an example embodiment, the image camera component **22** may include an IR light component **24**, a three-dimensional (3-D) camera **26**, and an RGB camera **28** that may be used to capture the depth image of a scene. For example, in time-of-flight analysis, the IR light component **24** of the capture device **20** may emit an infrared light onto the scene and may then use sensors (not shown) to detect the backscattered light from the surface of one or more targets and objects in the scene using, for example, the 3-D camera **26** and/or the RGB camera **28**.

According to another embodiment, the capture device **20** may include two or more physically separated cameras that may view a scene from different angles, to obtain visual stereo data that may be resolved to generate depth information.

The capture device **20** may further include a microphone **30**. The microphone **30** may include a transducer or sensor that may receive and convert sound into an electrical signal. According to one embodiment, the microphone **30** may be used to reduce feedback between the capture device **20** and the computing environment **12** in the target recognition, analysis, and tracking system **10**. Additionally, the microphone **30** may be used to receive audio signals that may also be provided by the user to control applications such as game applications, non-game applications, or the like that may be executed by the computing environment **12**. The capture device **20** may further include a variety of other sensors for sensing traits of a user in further embodiments.

In an example embodiment, the capture device **20** may further include a processor **32** that may be in operative communication with the image camera component **22**. The processor **32** may include a standardized processor, a specialized processor, a microprocessor, or the like that may execute instructions that may include instructions for receiving the depth image, determining whether a suitable target may be included in the depth image, converting the suitable target into a skeletal representation or model of the target, or any other suitable instruction.

The capture device **20** may further include a memory component **34** that may store the instructions that may be executed by the processor **32**, images or frames of images captured by the 3-D camera or RGB camera, or any other suitable information, images, or the like. According to an example embodiment, the memory component **34** may include random access memory (RAM), read only memory (ROM), cache, Flash memory, a hard disk, or any other suitable storage component. As shown in FIG. **2**, in one embodiment, the memory component **34** may be a separate component in communication with the image capture component **22** and the processor **32**. According to another embodiment, the memory component **34** may be integrated into the processor **32** and/or the image capture component **22**.

As shown in FIG. **2**, the capture device **20** may be in communication with the computing environment **12** via a communication link **36**. The communication link **36** may be a wired connection including, for example, a USB connection, a Firewire connection, an Ethernet cable connection, or the like and/or a wireless connection such as a wireless 802.11b, g, a, or n connection. According to one embodiment, the computing environment **12** may provide a clock to the capture device **20** that may be used to determine when to capture, for example, a scene via the communication link **36**.

Additionally, the capture device **20** may provide the depth information and images captured by, for example, the 3-D camera **26** and/or the RGB camera **28**, and a skeletal model that may be generated by the capture device **20** to the computing environment **12** via the communication link **36**. A variety of known techniques exist for determining whether a target or object detected by capture device **20** corresponds to a human target. Skeletal mapping techniques may then be used to determine various spots on that user's skeleton, joints of the hands, wrists, elbows, knees, nose, ankles, shoulders, and where the pelvis meets the spine. Other techniques include transforming the image into a body model representation of the person and transforming the image into a mesh model representation of the person.

The skeletal model may then be provided to the computing environment **12** such that the computing environment may perform a variety of actions. The computing environment may track the skeletal model and render an avatar associated with the skeletal model on an audiovisual display **14**. The computing environment may further determine which controls to perform in an application executing on the computer environment based on, for example, gestures of the user that have been recognized from the skeletal model. For example, as shown, in FIG. **2**, the computing environment **12** may include a gesture recognizer engine **190** for determining when the user has performed a predefined gesture. Gesture recognizer engine **190** is explained in greater detail hereinafter.

Data and other information obtained by the system **10** may be shared with one or more other systems and servers, such as for example via a network topology **50** shown in FIG. **3**. FIG. **3** shows system **10** described above (referred to in FIG. **3** as system **10-1**), as well as a variety of other systems **10-2**, **10-3**, . . . , **10**-n, each of which may include some or all of the components described above with respect to system **10**. Each of the systems **10-1** through **10**-n (collectively referred to as systems **10**) may be connected to a central service **52** via a network **51**. As explained in greater detail below, personal trait profile data may be collected for a user on any of the systems **10** and stored in a service database **62** of service **52**.

The computing environments **12** on each of the systems **10** may be the same or different computing environment, and may for example be a multimedia console, a personal computer (PC), a gaming system or console, a server, a handheld computing device, a PDA, a mobile phone, a cloud computer, or the like. The systems **10** may be networked to each other and service **52** via network **51**.

Network **51** may by the Internet, but may in general include for example an intranet, a personal area network (PAN), a campus area network (CAN), a local area network (LAN), a wide area network (WAN), a computer network, a gaming network, or the like. The topology **50** may utilize a network infrastructure such as client/server, peer-to-peer (as indicated by dashed arrow **54**), or hybrid architectures.

The network **51** may also represent the technology that connects individual devices in the network, such as optical fibre, a public switched telephone network (PSTN), a cellular telephone network, a global Telex network, wireless LAN, Ethernet, power line communications, or the like. Computing environments may be connected together by wired or wireless systems, by local networks or widely distributed networks. Any appropriate wireless interface can be utilized for network communications. For example, the wireless link can be in accordance with the following protocols: GSM, CDMA, UMTS, LTE, WIMAX, WIFI, ZIGBEE, or a combination thereof. A network may include cloud or cloud computing. A cloud infrastructure, for example, may include a multitude of services delivered through data centers and built on servers. The services may be accessible anywhere that provides access to the networking infrastructure. The cloud may appear to be a single point of access to the user and the infrastructure may not be visible to a client.

The service **52** may include, in part, one or more servers **56**, a login service **58** and a database **62**, also referred to herein as a central database. In embodiments, the service **52** may be the Xbox LIVE® gaming and media delivery service operated by Microsoft Corporation, though it may be other services in further embodiments. The servers **56** may include web servers and/or servers for hosting gaming or other applications to be played by users of systems **10**. The applications may alternatively be resident on the computing environments associated with the various systems **10**. Users of systems **10** may gain access to their account records **62** via user login service **58**, which is used to authenticate a user on a system **10**. In one example, during login, login service **58** obtains a gamer tag (a unique identifier associated with the user) and a password from the user, as well as a computing environment ID that uniquely identifies the system that the user is using. The gamer tag and password are authenticated by comparing them to user account records **64** in a database **62**. The database **62** may be located on the same server as user login service **58** or may be distributed on a different server or a collection of different servers. It is understood that the above-described authentication process may vary in alternative embodiments. Any of a variety of authentication schemes may be employed to identify a user so that he or she may connect to service **52** and access their user account records **64**.

User account records **64** may include additional information about a user, such as game records, statistics and achievements. User records may also include user profile data **66**, which may include a variety of information including contact and other descriptive information as well as a friends list. In accordance with the present technology, the profile data **66** may further store personal trait profile data **68** as explained below.

The respective computing environments **12** on systems **10** may execute their own applications, but are also able to access other computing environments on systems **10**, as well as applications executing on, or devices connected to, other computing environments, anywhere on the network **51**. Thus, a user of one computing environment **12** on a first system, e.g., system **10-1**, may use the network to share data (e.g., files, databases), interact with other applications, share devices (e.g., printers), communicate with other users (e.g., email, chat), etc. on one or more other systems **10**. Any number of users associated with any number of respective local computing environments may access the same application via the network **51**.

One item of data which may be generated by, and shared between, different systems **10** is a personal trait profile **68** (abbreviated herein as PTP **68** hereinafter). The PTP **68** is shown stored in database **62** on service **52**, but cached versions of PTP **68** may also be stored on respective systems **10**. The generation and composition of PTP **68** is explained below, but may in general include any trait associated with a given user which can be sensed by a sensor associated with a given system **10**. Different systems **10** may have different sensors.

The network topology **50** enables any computing environment that has access to the network to access the PTP **68** from service **52** or from the computing environment on another system **10**. Thus, a user **18** may generate data on a first system, e.g., system **10-1**, which is included in the PTP **68** and uploaded to database **62** on service **52**. Thereafter, the user may move to a different location, or use a different computing environment in the same location, and download the PTP **68** to that computing environment. Thus, according to one example of the present technology, a user may travel from his or her home system to a friend's house, or any other computing environment associated with network **51**, and have access to their PTP **68**. This feature of the present technology is explained in greater detail hereinafter.

A computing environment that generates or accesses a PTP **68** may also have associated metadata relating to the computing environment properties and specifications. For example, a computing environment may store RGB capabilities, screen size, available input devices, the range of the capture device, the components of the computing environment (e.g., audio/video capabilities), structure information, etc. The computing environment may use such information to modify the integration of the PTP **68** with the system and/or default gesture information. For example, a gesture may be defined by movement in the physical space that corresponds to movement from a top of a display portion of the display device to a bottom of the display portion of the display device. The user's PTP **68** may have been generated by a computing environment with a 60 inch display device and comprise a distance between the top and bottom of the display portion that corresponds to the distance on the 60 inch display device. On another computing environment, such as one with a 25 inch display device, the system may identify the smaller distance between the top and bottom of the screen such that the distance for recognizing the gesture corresponds to the smaller screen size. Similarly, if the physical room has a certain size, the computing environment may include the size in the analysis or modification of the integration of a gesture profile with the system and/or default gesture information. For example, if the user stands closer to the screen, the interpretation of the user's gestures may be considered in light of the size of the room.

In another example, the metadata may include information specific to the file structure of the local computing environment. For example, a first computing environment may run programs, load a gesture profile, or store the gesture profile in a particular location of the computing environment's hard drive, and a second computing environment may use a different location. Also, a computing environment having rich browsing capabilities may have the ability to do more with the PTP **68** data than, for example, a mobile phone. The metadata stored in association with the PTP **68** data adopts and optimizes the PTP data for a particular device.

FIGS. **4**A and **4**B illustrate two specific examples of computing environments which may exist on systems **10**. In one embodiment, the computing environment **12** described above with respect to FIGS. **1**A-**2** may be a multimedia console **100**, such as a gaming console. As shown in FIG. **4**A, the multimedia console **100** has a central processing unit (CPU) **101** having a level 1 cache **102**, a level 2 cache **104**, and a flash ROM **106**. The level 1 cache **102** and a level 2 cache **104** temporarily store data and hence reduce the number of memory access cycles, thereby improving processing speed and throughput. The CPU **101** may be provided having more than one core, and thus, additional level 1 and level 2 caches **102** and **104**. The flash ROM **106** may store executable code that is loaded during an initial phase of a boot process when the multimedia console **100** is powered ON.

A graphics processing unit (GPU) **108** and a video encoder/video codec (coder/decoder) **114** form a video processing pipeline for high speed and high resolution graphics processing. Data is carried from the GPU **108** to the video encoder/video codec **114** via a bus. The video processing pipeline outputs data to an A/V (audio/video) port **140** for transmission to a television or other display. A memory controller **110** is connected to the GPU **108** to facilitate processor access to various types of memory **112**, such as, but not limited to, a RAM.

The multimedia console **100** includes an I/O controller **120**, a system management controller **122**, an audio processing unit **123**, a network interface controller **124**, a first USB host controller **126**, a second USB host controller **128** and a front panel I/O subassembly **130** that are preferably implemented on a module **118**. The USB controllers **126** and **128** serve as hosts for peripheral controllers **142**(**1**)-**142**(**2**), a wireless adapter **148**, and an external memory device **146** (e.g., flash memory, external CD/DVD ROM drive, removable media, etc.). The network interface **124** and/or wireless adapter **148** provide access to a network (e.g., the Internet, home network, etc.) and may be any of a wide variety of various wired or wireless adapter components including an Ethernet card, a modem, a Bluetooth module, a cable modem, and the like.

System memory **143** is provided to store application data that is loaded during the boot process. A media drive **144** is provided and may comprise a DVD/CD drive, hard drive, or other removable media drive, etc. The media drive **144** may be internal or external to the multimedia console **100**. Application data may be accessed via the media drive **144** for execution, playback, etc. by the multimedia console **100**. The media drive **144** is connected to the I/O controller **120** via a bus, such as a Serial ATA bus or other high speed connection (e.g., IEEE 1394).

The system management controller **122** provides a variety of service functions related to assuring availability of the multimedia console **100**. The audio processing unit **123** and an audio codec **132** form a corresponding audio processing pipeline with high fidelity and stereo processing. Audio data is carried between the audio processing unit **123** and the audio codec **132** via a communication link. The audio processing pipeline outputs data to the A/V port **140** for reproduction by an external audio player or device having audio capabilities.

The front panel I/O subassembly **130** supports the functionality of the power button **150** and the eject button **152**, as well as any LEDs (light emitting diodes) or other indicators exposed on the outer surface of the multimedia console **100**. A system power supply module **136** provides power to the components of the multimedia console **100**. A fan **138** cools the circuitry within the multimedia console **100**.

The CPU **101**, GPU **108**, memory controller **110**, and various other components within the multimedia console **100** are interconnected via one or more buses, including serial and parallel buses, a memory bus, a peripheral bus, and a processor or local bus using any of a variety of bus architectures. By way of example, such architectures can include a Peripheral Component Interconnects (PCI) bus, PCI-Express bus, etc.

When the multimedia console **100** is powered ON, application data may be loaded from the system memory **143** into memory **112** and/or caches **102**, **104** and executed on the CPU **101**. The application may present a graphical user interface that provides a consistent user experience when navigating to different media types available on the multimedia console **100**. In operation, applications and/or other media contained within the media drive **144** may be launched or played from the media drive **144** to provide additional functionalities to the multimedia console **100**.

The multimedia console **100** may be operated as a standalone system by simply connecting the system to a television or other display. In this standalone mode, the multimedia console **100** allows one or more users to interact with the system, watch movies, or listen to music. However, with the integration of broadband connectivity made available through the network interface **124** or the wireless adapter **148**, the multimedia console **100** may further be operated as a participant in a larger network community.

When the multimedia console **100** is powered ON, a set amount of hardware resources are reserved for system use by the multimedia console operating system. These resources may include a reservation of memory (e.g., 16 MB), CPU and GPU cycles (e.g., 5%), networking bandwidth (e.g., 8 kbs), etc. Because these resources are reserved at system boot time, the reserved resources do not exist from the application's view.

In particular, the memory reservation preferably is large enough to contain the launch kernel, concurrent system applications and drivers. The CPU reservation is preferably constant such that if the reserved CPU usage is not used by the system applications, an idle thread will consume any unused cycles.

With regard to the GPU reservation, lightweight messages generated by the system applications (e.g., popups) are displayed by using a GPU interrupt to schedule code to render popup into an overlay. The amount of memory required for an overlay depends on the overlay area size and the overlay preferably scales with screen resolution. Where a full user interface is used by the concurrent system application, it is preferable to use a resolution independent of the application resolution. A scaler may be used to set this resolution such that the need to change frequency and cause a TV resynch is eliminated.

After the multimedia console **100** boots and system resources are reserved, concurrent system applications execute to provide system functionalities. The system functionalities are encapsulated in a set of system applications that execute within the reserved system resources described above. The operating system kernel identifies threads that are system application threads versus gaming application threads. The system applications are preferably scheduled to run on the CPU **101** at predetermined times and intervals in order to provide a consistent system resource view to the application. The scheduling is to minimize cache disruption for the gaming application running on the console.

When a concurrent system application requires audio, audio processing is scheduled asynchronously to the gaming application due to time sensitivity. A multimedia console application manager (described below) controls the gaming application audio level (e.g., mute, attenuate) when system applications are active.

Input devices (e.g., controllers **142(1)** and **142(2)**) are shared by gaming applications and system applications. The input devices are not reserved resources, but are to be switched between system applications and the gaming application such that each will have a focus of the device. The application manager preferably controls the switching of input stream, without knowledge of the gaming application's knowledge and a driver maintains state information regarding focus switches. The cameras **26**, **28** and capture device **20** may define additional input devices for the console **100**.

FIG. **4B** illustrates another example embodiment of a computing environment **220** that may be the computing environment **12** shown in FIGS. **1A-2** used to interpret one or more positions and motions in a target recognition, analysis, and tracking system. The computing system environment **220** is only one example of a suitable computing environment and is not intended to suggest any limitation as to the scope of use or functionality of the presently disclosed subject matter. Neither should the computing environment **220** be interpreted as having any dependency or requirement relating to any one or combination of components illustrated in the exemplary operating environment **220**. In some embodiments, the various depicted computing elements may include circuitry configured to instantiate specific aspects of the present disclosure. For example, the term circuitry used in the disclosure can include specialized hardware components configured to perform function(s) by firmware or switches. In other example embodiments, the term circuitry can include a general purpose processing unit, memory, etc., configured by software instructions that embody logic operable to perform function(s). In example embodiments where circuitry includes a combination of hardware and software, an implementer may write source code embodying logic and the source code can be compiled into machine readable code that can be processed by the general purpose processing unit. Since one skilled in the art can appreciate that the state of the art has evolved to a point where there is little difference between hardware, software, or a combination of hardware/software, the selection of hardware versus software to effectuate specific functions is a design choice left to an implementer. More specifically, one of skill in the art can appreciate that a software process can be transformed into an equivalent hardware structure, and a hardware structure can itself be transformed into an equivalent software process. Thus, the selection of a hardware implementation versus a software implementation is one of design choice and left to the implementer.

In FIG. **4B**, the computing environment **220** comprises a computer **241**, which typically includes a variety of computer readable media. Computer readable media can be any available media that can be accessed by computer **241** and includes both volatile and nonvolatile media, removable and non-removable media. The system memory **222** includes computer storage media in the form of volatile and/or nonvolatile memory such as ROM **223** and RAM **260**. A basic input/output system **224** (BIOS), containing the basic routines that help to transfer information between elements within computer **241**, such as during start-up, is typically stored in ROM **223**. RAM **260** typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by processing unit **259**. By way of example, and not limitation, FIG. **4B** illustrates operating system **225**, application programs **226**, other program modules **227**, and program data **228**. FIG. **4B** further includes a graphics processor unit (GPU) **229** having an associated video memory **230** for high speed and high resolution graphics processing and storage. The GPU **229** may be connected to the system bus **221** through a graphics interface **231**.

The computer **241** may also include other removable/non-removable, volatile/nonvolatile computer storage media. By way of example only, FIG. **4**B illustrates a hard disk drive **238** that reads from or writes to non-removable, nonvolatile magnetic media, a magnetic disk drive **239** that reads from or writes to a removable, nonvolatile magnetic disk **254**, and an optical disk drive **240** that reads from or writes to a removable, nonvolatile optical disk **253** such as a CD ROM or other optical media. Other removable/non-removable, volatile/nonvolatile computer storage media that can be used in the exemplary operating environment include, but are not limited to, magnetic tape cassettes, flash memory cards, digital versatile disks, digital video tape, solid state RAM, solid state ROM, and the like. The hard disk drive **238** is typically connected to the system bus **221** through a non-removable memory interface such as interface **234**, and magnetic disk drive **239** and optical disk drive **240** are typically connected to the system bus **221** by a removable memory interface, such as interface **235**.

The drives and their associated computer storage media discussed above and illustrated in FIG. **4**B, provide storage of computer readable instructions, data structures, program modules and other data for the computer **241**. In FIG. **4**B, for example, hard disk drive **238** is illustrated as storing operating system **258**, application programs **257**, other program modules **256**, and program data **255**. Note that these components can either be the same as or different from operating system **225**, application programs **226**, other program modules **227**, and program data **228**. Operating system **258**, application programs **257**, other program modules **256**, and program data **255** are given different numbers here to illustrate that, at a minimum, they are different copies. A user may enter commands and information into the computer **241** through input devices such as a keyboard **251** and a pointing device **252**, commonly referred to as a mouse, trackball or touch pad. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit **259** through a user input interface **236** that is coupled to the system bus, but may be connected by other interface and bus structures, such as a parallel port, game port or a universal serial bus (USB). The cameras **26**, **28** and capture device **20** may define additional input devices for the console **100**. A monitor **242** or other type of display device is also connected to the system bus **221** via an interface, such as a video interface **232**. In addition to the monitor, computers may also include other peripheral output devices such as speakers **244** and printer **243**, which may be connected through an output peripheral interface **233**.

The computer **241** may operate in a networked environment using logical connections to one or more remote computers, such as a remote computer **246**. The remote computer **246** may be a personal computer, a server, a router, a network PC, a peer device or other common network node, and typically includes many or all of the elements described above relative to the computer **241**, although only a memory storage device **247** has been illustrated in FIG. **4**B. The logical connections depicted in FIG. **4**B include a local area network (LAN) **245** and a wide area network (WAN) **249**, but may also include other networks. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets and the Internet.

When used in a LAN networking environment, the computer **241** is connected to the LAN **245** through a network interface or adapter **237**. When used in a WAN networking environment, the computer **241** typically includes a modem **250** or other means for establishing communications over the WAN **249**, such as the Internet. The modem **250**, which may be internal or external, may be connected to the system bus **221** via the user input interface **236**, or other appropriate mechanism. In a networked environment, program modules depicted relative to the computer **241**, or portions thereof, may be stored in the remote memory storage device. By way of example, and not limitation, FIG. **4**B illustrates remote application programs **248** as residing on memory device **247**. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

FIG. **5** depicts an example skeletal mapping of a user that may be generated from the capture device **20**. In this embodiment, a variety of joints and bones are identified: each hand **302**, each forearm **304**, each elbow **306**, each bicep **308**, each shoulder **310**, each hip **312**, each thigh **314**, each knee **316**, each foreleg **318**, each foot **320**, the head **322**, the torso **324**, the top **326** and the bottom **328** of the spine, and the waist **330**. Where more points are tracked, additional features may be identified, such as the bones and joints of the fingers or toes, or individual features of the face, such as the nose and eyes.

By the capture device **20** obtaining position and/or movement data for different joints, the computing environment is able to compare this data against stored data in order to determine if the user has performed a predefined gesture. Once a predefined gesture is identified, the computing environment then performs the action associated with the predefined gesture. Gesture recognition is performed by the gesture recognition engine **190** as explained hereinafter.

Aspects of the present technology related to PTP **68** will now be explained with reference to FIGS. **6** through **10**. FIG. **6** is a high level flowchart illustrating the collection and upload of PTP data. In step **400**, a system **10** is launched by a user. In step **402**, trait data for the PTP **68** is acquired. The personal trait profile data can be data relating to any trait associated with a user which can be sensed by a sensor which may be included within the system **10**. Sensors which have been described above for this purpose include capture device **20** having 3-D camera **26**, RGB camera **28** and/or microphone **30**. It is understood that other sensors may be included within system **10** for collecting PTP data. One such additional sensor could be an olfactic (smell) sensor.

Given the above definition, PTP data may comprise a wide range of trait information from users, including for example how they look and what they wear, their mannerisms and how they act, any personalized gestures, and how they sound. It is contemplated that other sensed trait data may be included in PTP **68** in further embodiments.

With respect to how a user looks, data for PTP **68** may include the user's size and shape (on a per-body part basis), facial features, head and/or facial hair (style, length and color), any distinct physical characteristics and whether the user is a man or a woman.

With respect to how a user may act, PTP **68** may include data relating to a user's particular body language and/or facial expressions. Such body language data may relate to, for example, a penchant for a user to tap a foot, chew the inside of the cheek, bite fingernails, certain head movements or nervous tics, crack their knuckles, etc. The user may also have certain facial expressions or facial tics which can be sensed and included in a user's PTP **68**. PTP **68** may further include whether the user is left or right handed.

Data for PTP **68** may further include how a user performs certain gestures. In particular, a user may have physical limitations or simply learned to perform certain common motions in an atypical manner. For example, Europeans may be used to the game of cricket, where a bowler delivers the ball in a roundhouse motion. If such a user is asked to pitch a ball in an American baseball game, his or her roundhouse delivery may not be recognized as matching a predefined pitching gesture. However, over time, a system may come to recognize that user's motion as a particular gesture, and set up a special rule so that the user's motion is then recognized as that gesture going forward. Alternatively, the user may set up a special definition of a gesture in a special gesture-learning session with the system. In particular, a system **10** may provide the user with an option to perform certain gestures, which are recorded by the system, and then allow the user to associate certain actions with that manually created gesture. In such a session, the user may assign certain atypical motions to one or more predefined gestures and/or a user may assign certain arbitrary motions as one or more predefined gesture shortcuts. All of this data may be stored in a user's PTP **68**.

In a similar manner, the system can learn character traits that are not intended as gestures, thereby reducing false positive identification of gestures. For example, if a user is prone to scratch their head (or perform any number of other habits), at times the system may interpret that as a gesture. Over time, the user may indicate that such a motion is not intended as a gesture. The system can learn that and store that information in PTP **68** (i.e., that a particular movement is not a gesture). Thus, when the user thereafter performs that habit, the system understands not to interpret that as a gesture.

In embodiments, data for a user's PTP **68** may further include what the user wears. It may happen that a user is prone to wearing a particular color or type of clothing, either everyday, or once every periodic time period (such as the same day every week). These traits may be sensed by the capture device **20** and computing environment **12**, and included in PTP **68**.

PTP **68** may include multi-modal data. Thus, in addition to appearance data, PTP **68** may include speech data relating to a user. Such data may include a wide variety of traits relating to speech, such as for example accent, pitch, tenor, cadence and whether the user stutters. Other voice and speech data is contemplated.

The above description of what user traits may be included within PTP **68** is by way of example only, and it will be appreciated that a variety of other traits associated with a particular user may be included within that user's PTP **68** in further embodiments.

Referring again to FIG. **6**, trait data for PTP **68** is acquired in step **402**. This step may involve an active or passive gathering of PTP information. For example, the system could prompt a user to speak a certain word or phrase, prompt a user to perform a given gesture or have the user perform some other act that then forms part of the user's PTP **68**. The system may prompt a user to speak or perform a given gesture exemplifying a particular trait one or more times so that the system may obtain a good baseline for that particular trait. The above described steps for actively gathering information may be performed automatically by the computing environment **12**, or a user may indicate to the computing environment **12** that they wish to enter a mode where they record trait information for inclusion in their PTP **68**. As an alternative to active trait gathering, the system may passively gather trait data in step **402**. That is, the system can gather trait data for the user's PTP **68** as the user engages in normal interaction with the system **10**.

While it is possible that data for a particular trait is gathered once and stored in the user's PTP **68**, the system **10** may continuously refine stored trait data in PTP **68** over time. Thus, for example, as a user gains or loses weight, grows or shaves a beard or changes their hairstyle, the user's PTP **68** would be updated with new data to reflect the user's current characteristics. Those of skill will appreciate various data structures and fields which may be used to store a PTP **68** in such a way that specific fields may be created, accessed and/or updated.

In step **404** of FIG. **6**, the computing environment **12** may store trait data within a version of PTP **68** that is stored locally in memory associated with computing environment **12**. This cached version of a user's PTP **68** may be used when a connection to service **52** is unavailable for upload or download of PTP **68** data. Assuming a connection is available to service **52**, the trait data may be uploaded to service **52** in step **406** and stored in service database **62** as described above. PTP **68** may be created and/or added to by a user **18** from any system **10** at which the user is located when the system **10** is networked to service **52**.

Referring now to the flowchart of FIG. **7**, with the present technology, a user **18** may have the ability to access their PTP **68** from any system having a network connection to service **52**. A user may alternatively or additionally access a version of PTP **68** from a first system **10** instead of service **52** while located at another system **10**. In step **410**, the user may launch a system **10** at which they are located. In step **414**, the system checks whether the user is properly authenticated using an established authentication protocol. If not authenticated, the user may continue using the system **10** in step **420** but without access to the PTP **68**.

Assuming the user is properly authenticated, the system next determines whether a PTP **68** is available in step **424**. The system may check with service **52** for a stored PTP. Alternatively or additionally, the system **10** may check whether other systems **10** have an available version of the user's PTP. If no PTP **68** is available in step **424**, the system **10** may check whether it has a local cached PTP available in step **428**. If a PTP is available from service **52** in steps **424**, or a local cached version of PTP is available in step **428**, that PTP is loaded in step **432**. If there is no available PTP in steps **424** or **428**, the system **10** may continue in step **420** without the PTP.

The storing of PTP **68** data in the cloud so that it may be accessible to a user **18** at different systems **10** provides several benefits. First, cloud storage of PTP **68** enhances the user experience in that a user's personalized, atypical and/or idiosyncratic gestures and interactions with a NUI system may be available at any networked system at which the user is located. Thus, each system at which a user is located may be tuned to that user's style and pattern of interaction at the start of the user's session, without the user having to endure failed gesture recognition and/or a learning curve as the system becomes familiar with the user. A user can use any system as if it was their home system. Even when using a system for the first time, that system knows their PTP data and is tuned to that data. Use of PTP **68** may further serve to personalize a user's experience, regardless of which system **10** the user is using.

In addition to the above-described improved user experiences, a cloud-based PTP **68** can be used to aid in user identification and authentication. In particular, the sum total of a user's PTP data, or even portions thereof, may serve to uniquely identify that user from all other users. As such, PTP data can be used as part of and/or in conjunction with any of various authentication protocols so as to authenticate whether a user is in fact who the systems believes the user to be.

FIG. **8** shows one example of how a PTP **68** may be incorporated into an authentication protocol for authenticating a user on a system **10**. In step **440**, a user may launch a system **10** at which the user is located. In step **442**, the system **10** may receive a user ID such as a gamer tag or other identification. In step **446**, the system **10** or service **52** may determine whether the system at which the user is located is a trusted system for that user. Trusted systems may include systems from which the user frequently connects from (such as a home or work system), a system within a predefined radius of the user's home or work system, and/or a system registered to a friend of the user as indicated by the user's friend list. Those with skill in the art will appreciate other criteria by which a given system may be considered to be or not to be a trusted system for a user.

If the system is a trusted system in step **336**, the system may next check whether a conflict exists in step **450**. A conflict may exist where for example that same user is shown to be online at another system in another location. A conflict may further exist if the service **52** shows that the user was logged on at another system and could not have gotten from that system to the current system in the time elapsed. Such a conflict is referred to herein as a geo-temporal conflict. If no conflict is detected in step **450**, the system may allow access in step **452**. If a conflict is found to exist, additional security checks may be required, such as for example prompting the user to perform certain gestures as explained below with respect to step **454**.

In the above steps, if the system was a trusted system and there was no conflict, the user is given access to system resources without looking at a user's PTP **68**. In further embodiments, step **446** may be skipped. In such an embodiment, the system may look at a user's PTP **68** and compare that to live data received from the current system (as explained below) regardless of whether the user is at a trusted system.

Returning to step **446**, if the system is not a trusted system for that user, the system may access stored PTP data and compare that data to live data acquired by the system requesting access to the system resources in step **454**. For example, a system may examine PTP data related to the user's physical appearance such as height, weight, facial features, etc., and compare that data against live data obtained by capture device **20** for the user attempting to gain access to the system. In further embodiments, the system may prompt the user to perform certain gestures for which PTP data exists. These gestures may for example be shortcut gestures or other gestures that a user has stored in his or her PTP **68**.

If there is a match between the stored and live data in step **458**, the system may allow access to the user in step **452**. If no match is found in step **458**, the system may deny access to its resources to the user in step **466**. In order not to lock out legitimate users, the system may check in step **462** if the confidence level as to a non-match exceeds some predefined threshold. If not, the system may return to **454** to obtain and compare additional live trait data against stored PTP data. If on the other hand, the system is clear that there is no match, the system may deny access to the user to system resources in step **466**.

In further embodiments, the system may use multiple devices together with PTP data in confirming a user's identification. In one such example, a mobile phone or some other mobile handheld device may be a system **10** with a cached version of PTP **68** data. When a user brings that device within proximity of a second system **10**, the systems may communicate with each other and the cached version of the PTP **68** on the mobile device may be compared against the PTP **68** stored locally on the second system **10** or accessed from service **52**. If there is a match, the system **10** may consider the user authenticated and allow access to the user.

As noted above, one feature of the present technology is to create and recognize specialized gestures and gesture shortcuts. Those of skill in the art will understand a variety of methods of analyzing acquired parameters to determine whether the parameters conform to a predefined gesture. Such methods are disclosed for example in the above incorporated application Ser. No. 12/475,308, as well as U.S. Patent Publication No. 2009/0074248, entitled "Gesture-Controlled Interfaces For Self-Service Machines And Other Applications," which publication is incorporated by reference herein in its entirety. However, a gesture recognition engine **190** for recognizing gestures according to embodiments of the present technology is explained in greater detail with reference to the block diagram of FIG. **9** and the flowchart of FIG. **10**.

The gesture recognition engine **190** receives pose information **500** in step **550**. The pose information may include a great many parameters, including the x, y and z minimum and maximum image plane positions detected by the capture device **20** for various joints. The parameters may also include a measurement of the velocity and acceleration for discrete time intervals for various joints. Thus, in embodiments, the gesture recognition engine **190** can receive a full picture of the position and kinetic activity of all points in the user's body.

Predefined gestures may be stored in a gestures library **540** which may be specific to a particular application running on a computing environment **12** or generic to a computing environment **12**. The library **540** may be stored locally in a computing environment **12**, or remotely on service **52** or on another system **10**. Library **540** includes stored rules **542**, which describe when particular positions and/or kinetic motions indicated by the pose information **500** are to be interpreted as a predefined gesture. In embodiments, each gesture may have a different, unique rule or set of rules **542**. Each rule may have a number of parameters (joint position vectors, maximum/minimum position, change in position, etc.) for one or more of the body parts shown in FIG. **5**. A stored rule may define, for each parameter and for each body part **302** through **330** shown in FIG. **5**, a single value, a range of values, a maximum value, a minimum value or an indication that a parameter for that body part is not relevant to the determination of the gesture covered by the rule. Rules may be created by a game author, by a host of the gaming platform or by users themselves.

As described above, user **18** may perform certain gestures in an atypical manner which may not ordinarily be identified by a rule **542** in library **540**. As such, a user's PTP **68** may store special definitions **70** of gestures that are specific to that user. One such special gesture mentioned above is a roundhouse motion by a cricket player who is playing a baseball game. There are a wide variety of other special gestures and gesture shortcuts which may exist. These special definitions **70** may relate to any gesture that a user may perform in an unusual, atypical and/or arbitrary manner which may not otherwise be identified by a rule **542** in gestures library **540**.

The gesture recognition engine **190** analyzes the received pose information **500** in steps **552** and **554** to see if the pose information matches any rule definition **70** in the user's PTP **68**, or a predefined rule **542** stored within a gestures library **540**. The gesture recognition engine **190** may output both an identified gesture and a confidence level which corresponds to the likelihood that the user's position/movement corresponds to that gesture. In particular, in addition to defining the parameters required for a gesture, a definition **70** and/or rule **542** may further include a threshold confidence level required before pose information **500** is to be interpreted as a gesture. Some gestures may have more impact as system commands or gaming instructions, and as such, require a higher confidence level before a pose is interpreted as that gesture. The comparison of the pose information against the stored parameters for a rule results in a cumulative confidence level as to whether the pose information indicates a gesture.

Once a confidence level has been determined as to whether a given pose or motion satisfies a given gesture definition or rule, the gesture recognition engine **190** then determines in step **556** whether the confidence level is above a predetermined threshold for the rule under consideration. The threshold confidence level may be stored in association with the rule under consideration. If the confidence level is below the threshold, no gesture is detected (step **560**) and no action is taken. On the other hand, if the confidence level is above the threshold, the user's motion is determined to satisfy the gesture rule under consideration, and the gesture recognition engine **190** returns the identified gesture. Those of skill in the art will appreciate variations on the above-described steps for detecting predefined gestures in library **540** and/or in a user's PTP **68**.

The foregoing detailed description of the inventive system has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the inventive system to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. The described embodiments were chosen in order to best explain the principles of the inventive system and its practical application to thereby enable others skilled in the art to best utilize the inventive system in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the inventive system be defined by the claims appended hereto.

What is claimed:

1. A method of improving a user experience with natural user interface systems, comprising:

a) acquiring user-specific trait data representing a user-specific trait of a user from a sensor of a natural user interface associated with a first computing environment, acquiring the user-specific trait data comprising the step of acquiring and storing, over time, user-specific data relating to an atypical manner in which the user performs a predefined gesture to refine a stored gestural rule defining how the predefined gesture is performed;

b) storing the trait data acquired in said step a) in a location accessible to a second computing environment distinct from the first computing environment;

c) providing the trait data stored in said step b) to the second computing environment;

d) receiving a first version of the personal trait data stored on the second computing environment by the third computing environment, the third computing environment having access to the personal trait data independently of the second computing environment;

e) comparing, by the third computing environment, the first version of the personal trait data received from the second computing environment with a second version of the personal trait data received independently of the second computing environment to validate the second computing environment; and

f) using the stored trait data in the second computing environment to decrease misinterpretation of the user performing the gesture user's gestures performed in interacting with the second computing environment.

2. The method of claim **1**, said step b) comprising the step of storing the trait data in a third computing environment accessible to the first and second computing environments.

3. The method of claim **2**, said step of storing the trait data in a third computing environment comprising the step of storing the trait data in a central database associated with one or more servers in a server-client network topology, the first and second computing environments comprising clients capable of accessing the central database.

4. The method of claim **1**, the capture device comprising a first capture device, the method further comprising the step of adding to the personal trait profile for the user from data representing a trait of the user received from a second capture device associated with the second computing environment.

5. The method of claim **1**, further comprising the step of updating data for a trait in the personal trait profile for the user from data representing the trait of the user received from the capture device associated with the first computing environment.

6. The method of claim **1**, said step of the third computing environment having access to the personal trait data independently of the second computing environment in said step c) comprising the step of storing the personal trait profile in at least one of: (i) a central database accessible to the third computing environment via a client-server network topology; and (ii) the third computing environment.

7. The method of claim **1**, further comprising the step of the third computing environment using the trait data to improve a performance of the third computing environment in interpreting the user's gestures with the third computing environment.

8. A method of improving a user experience with natural user interface systems, comprising:

a) acquiring data representing a trait of a user from a sensor of a natural user interface associated with a first computing environment, acquiring the trait data comprising the step of acquiring and storing, over time, user-specific data relating to an atypical manner in which the user performs a predefined gesture to refine a stored gestural rule defining user movements and/or positions that comprise the predefined gesture;

b) storing the trait data acquired in said step a) in a second, mobile computing environment distinct from the first computing environment;

c) pairing the second, mobile computing environment with a third computing environment distinct from the second, mobile computing environment when the second and third computing environments are proximate to each other, the second, mobile computing environment transmitting the trait data stored on the second, mobile computing environment to the third computing environment upon said pairing; and

d) comparing the trait data received from the second, mobile computing environment in said step c) against trait data for the user stored in the third computing environment; and

e) allowing or disallowing the user access to resources on the third computing environment depending on results of the comparison performed in said step d).

9. The method of claim **8**, said step a) of acquiring data representing a trait of a user comprising the step of generating a personal trait profile from data representing least one of the user's physical characteristics, the user's voice and gestures performed by the user.

10. The method of claim **8**, further comprising the step of the third computing environment using the trait data received from the second computing environment to improve a performance of the third computing environment in interpreting the user's gestures with the third computing environment.

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